MONTHLY LETTER OF THE BUREAU OF ENTOMOLOGY

UNITED STATES DEPARTMENT OF AGRICULTURE

Number 239 (Not for publication) April 1934

GENERAL

Thirty millions for spray materials.--W. H. White, of the Division of Truck Crop and Garden Insects, calls attention to the fact that more than $30,000,000 worth of insecticide materials were used in the United States in 1932, according to figures compiled by R. C. Roark, of the Bureau of Chemistry and Soils, as reported in the Florists Exchange and Horticultural Trade World, Vol. 82, No. 11, March 17, 1934. More than half of the total was expended for arsenicals, the items of heaviest consumption being lead arsenate and calcium arsenate, about 30,000,000 pounds of each, the estimated costs to consumers being $8,100,000 and $3,900,000, respectively. Paris green consumption was placed at 5,000,000 pounds, at a cost of $3,750,000, and other arsenicals totaled about 320,000 pounds, valued at $86,000. Fluorides used totaled about 250,000 pounds, valued at $45,500; and expenditures for fumigants were about $1,398,950, of which $1,000,000 went for liquid hydrocyanic acid and sodium cyanide. One million pounds of paradichlorobenzene, valued at $300,000, were used. Fungicide consumption included 5,000,000 gallons of oil emulsions ($1,900,000); 3,000,000 gallons of lime sulphur solution ($1,140,000); 2,000,000 pounds of Bordeaux mixture ($560,000); and 2,000,000 pounds of superfine sulphur ($112,000). Among the insecticides of plant origin were used 10,000,000 pounds of pyrethrum ($4,600,000); 2,500,000 pounds of 40-percent nicotine ($5,000,000); 100,000 pounds of derris ($48,000); and 10,000 pounds of hellebore ($34,000). Other materials included 2,000,000 pounds of soaps ($60,000) and 1,050,000 pounds of weed killers ($107,000).

FRUIT INSECTS

Tartar emetic kills the West Indian fruit fly more quickly than do other poisons.--L. C. McAlister, Jr., Mayaguez, Puerto Rico, reports the results of experiments conducted in Puerto Rico to determine the effect of lead arsenate, nicotine sulphate, and tartar emetic on Anastrepha acidusa Walk. The poison spray was applied to wax paper, which was suspended in the cages, and sliced orange was present in the cages at all times for food. All flies used in the tests were from 5 to 10 days old when they were introduced into the cages. The results are summarized in the following table:

Material	Cages	Flies used	Flies dead in 72 hours	Flies dead in 144 hours
	Number	Number	Percent	Percent
Lead arsenate 4 to 100 [a]	4	100	4.0	10.0
Lead arsenate 8 to 100 [a]	8	200	5.5	20.5
Nicotine sulphate 1 to 200 [b]	4	100	14.0	25.0
Nicotine sulphate 1 to 100 [b]	8	200	9.5	31.5
Tartar emetic 4 to 100 [c]	4	100	100.0	--
Tartar emetic 2 to 100 [c]	8	200	75.0	100.0
Check, no poison	2	200	1.5	3.5

[a] Used with cane molasses, 5 gallons per 100 gallons, and cane sugar, 25 pounds per 100 gallons of spray.
[b] Forty percent solution used with cane molasses, 10 gallons per 100 gallons of spray.
[c] Used with cane molasses, 5 gallons per 100 gallons of spray.

JAPANESE AND ASIATIC BEETLES

Fluctuation in grub populations of the Jap beetle.---Changes in soil population frequencies since the current brood of larvae of Popillia japonica Newm. reached its greatest abundance in September 1933, as reported by H. Fox, Moorestown, N. J., are shown in the following table, which summarizes records on seasonal surveys.

Soil populations of Japanese beetle at stations within 10 miles of original center of spread

Period	Average population per square foot		
	New Jersey stations	Pennsylvania stations	General
Sept. 1-15	6.6	9.9	8.3
16-30	7.5	10.4	9.0
Oct. 1-15	6.9	10.6	8.8
16-31	6.8	9.1	8.0
Nov. 1-15	6.9	8.6	7.8
16-30	6.4	8.1	7.3
Dec. 1-15	[a] 6.7	7.8	[a] 7.3
Jan. 1-15	6.5	8.3	7.4
16-31	[a] 4.9	8.7	[a] 6.8
Mar. 16-31	5.1	6.6	5.9

[a] Records not quite complete.

These records indicate an apparently steady decrease of populations during the winter. The general average number of larvae per square foot late in March was about 6, whereas in November it was about 7.5, indicating an apparent winter mortality of approximately 20 percent. The decrease recorded for January is 9 percent, and a further decrease of approximately 11 percent in February and March is indicated. These figures are based on relatively few surveys and experience has shown that surveys made in March may not necessarily give a true indication of the actual situation, since soil and weather conditions generally obtaining during this month are frequently rather unfavorable in making accurate grub surveys.

Records of annual fluctuations in population, which involve comparisons of more than a single brood, are available only in seasonal surveys. A comparison of these records for March 1933 and 1934 follows:

Soil-population frequencies of Japanese beetle in March 1933 and 1934

Stations	Period	Average soil population per square foot	
		1933	1934
General	March 16-31	10.1	5.9
New Jersey	March 16-31	7.0	5.1
Pennsylvania	March 16-31	13.2	6.6

These records indicate a very substantial reduction of grub population in the area covered.

Stomach poisons in soil.--Tests by W. E. Fleming, F. E. Baker, and L. Koblitsky, Moorestown, have been continued with third-instar larvae, using material as stomach poisons under controlled conditions. Thus far, the tests with C. P. rotenone, and with derris containing 4 percent rotenone, have indicated that these materials are of little value, even when used at the rate of 2,000 pounds per acre.

PWA and CWA Building Projects

Public Works allotments.--Public Works funds were allotted to the Moorestown, N. J., laboratory for four projects, providing for rebuilding storage sheds, rebuilding the insectary, rebuilding existing greenhouses, and building two additional greenhouses, and for general repairs, painting, and rendering fireproof the Government-owned laboratories and storage buildings. This work was completed in March. Rebuilt structures included a storage shed with a ground size of 42 by 134 feet; combined insectary and workrooms, ground size of 30 by 34 feet, with small rebuilt greenhouse attached; two new greenhouses, each 21 feet 4 inches by 51 feet, with attached combined headhouse and potting shed, size 16 by 72 feet, and two existing greenhouses rebuilt into one house, size 16 by 51 feet. In addition, all of the other laboratories and storage sheds were covered on the outside with sheet metal and were repainted and repaired.

Civil Works allotment.--Civil Works funds were allotted to the Moorestown, N. J., laboratory to provide for remodeling and rebuilding the general parasite laboratory. This project has now been completed. Much of the interior of the building was torn out and rebuilt and a cellar was excavated under the entire structure. This cellar, which is 28 by 81 feet, contains six temperature-controlled rooms, each 7 by 10 by 7 feet. These rooms are standardly insulated with 4 inches of pressed cork on all sides, over which is a layer of $\frac{3}{4}$-inch waterproof cement plaster. Standard refrigeration doors furnish entrance to each chamber. Three of the rooms are equipped with sufficient refrigeration elements to permit their being set individually and retained automatically to run at temperatures from 40° to 60° F. The three chambers of the second set have less cooling capacity, so that by the introduction of automatically controlled heating elements they may be run individually at 60° F. or at any desired temperature above this point. The refrigeration unit for the chambers is a York, 2-ton, direct expansion "Freon" compressor, which is a closed system similar in principle to refrigeration units used in electric refrigerators. "Freon", or "F-12" (trade names for dichlorodifluoromethane), seems to be an ideal refrigerant for such cellars, for in case of any leakage the gas generated is nontoxic and nonexplosive. Provision for humidity in each of the chambers consists of an atomizer which throws a fine cloud of mist directly into the air. The atomizer is electrically controlled by an automatic hydrostat.

The ground floor of the building was rearranged so that the parasite division is now provided with four large heated workrooms. The largest workroom is L-shaped and is 13 by 35 feet, with an offset of 14 by 12 feet, thus providing ample room for working tables. Adjoining this is a small laboratory room, 12 by 10 feet, for microscopic and general laboratory work. A third room, known as the quarantine room, joins the main workroom through a short hallway. This room is 13 feet 5 inches by 22 feet and is specially constructed so as to prevent the escape of any insect while foreign shipments are being unpacked and examined. The four windows consist of double-weight glass set in putty so as to be absolutely tight. The floor is double and the walls are plastered and painted white. The entrance to this room is guarded by two vestibules each containing a trap window and closed by heavily felted doors which seal the entrance when closed. The room temperature may be reduced during hot weather to an equable temperature for work with insects by a cooling unit which is operated by the refrigeration unit in the cellar. If humidity is required this may be easily accomplished with the Burrell humidifier (Jour. Econ. Ent. 23, pp 994-997). In one corner of the quarantine room is a small sterilizing compartment provided with water and with a gas heater for boiling moss or other packing material. The fourth room, which is off the central entrance, is 13 by 15 feet. This is known as the map room and will provide working and storage space for all map work in which parasite colonies are recorded.

Aside from the four rooms occupied by the parasite division, there are five additional rooms in the building. One of these houses the photographic equipment and darkroom, the photographic room being 13 by 12 feet, and the darkroom, 8 by 13 feet. Next to the photographic room is an insecticide laboratory room, 13 feet 7 inches by 15 feet 8 inches, equipped with all necessary bench space, water, and electrical outlets. In a small wing of this building there are three offices, each approximately 11 by 15 feet. At present one of these rooms is occupied by Frank Irons, of the Bureau of Agricultural Engineering, cooperating in investigations on control of the Japanese beetle by machinery. Another room is occupied by F. M. Wadley, of the Bureau of Entomology, whose work is in connection with the Dutch elm disease.

TRUCK CROP AND GARDEN INSECTS

Status of celery leaf tier in Florida.--According to reports submitted by C. F. Stahl, the low numbers of Phlyctaenia rubigalis Guen. in the Sanford, Fla., area may be attributed to the subnormal temperatures throughout the period from mid-January to the end of March. Because of this low temperature only a slight development of the celery leaf tier occurred in the field and the broods were not as

well defined as under more normal weather conditions. During March an average of approximately 3 adults per row were found in some of the fields of mature celery, whereas ordinarily an average of 50 adults per row were found just prior to the incidence of heavy infestations. At the close of March celery was being rapidly harvested from the fields and it appeared unlikely that leaf tier control would be necessary. In fact, the infestation has not been sufficient to allow the application of experimental insecticide tests.

Winter mortality of Mexican bean beetle.---N. F. Howard and H. C. Mason report that at Columbus, Ohio, the samples of Epilachna corrupta Muls. taken from hibernation cages on March 15 indicated a beetle survival of approximately 32 percent, as compared with a survival of 36 percent for the same period in 1933. A minimum air temperature of -15° F. and a minimum "undercover" temperature of 18° F. were recorded at Columbus during February 1934.

R. L. Wallis reports that at the close of March the Mexican bean beetle survival in the hibernation cages located on both the north and south slope exposures of the foothills of the Estancia Valley, N. Mex., varied from slightly less than 10 percent on the north slope exposures to slightly more than 10 percent on the south. The high percentage of winter mortality is apparently attributed to the small amount of precipitation during the autumn, winter, and spring, as the temperatures have been above normal during this period.

Hibernation studies on Mexican bean beetle at Norfolk, Va., emphasize importance of clean-up measures.---Examinations were conducted by L. W. Brannon, Norfolk, Va., on January 8, for adults of E. corrupta in hibernation in an old pole lima bean field in which the dead vines were matted about the poles at the surface of the ground. A total of 99 live beetles were collected on .003 acre, or at the rate of approximately 33,000 per acre. The results emphasize the importance of cleaning up all plant debris in the fall after the crop is harvested in order to reduce the infestation the following spring. On February 20 additional examinations were made in this same field and live beetles were found. These beetles had survived a mimimum temperature of 6° F. on February 9.

Tests show close correlation between temperature and kill of harlequin bug with rotenone sprays.---In conducting field toxicity tests on Murgantia histrionica Hahn in 1933, Mr. Brannon observed that 20 adults in each treatment, when sprayed in the field and placed in field cages over sprayed plants, yielded the following data:

Date of treatment	Temperature	Relative humidity	Kill
	°F.	Percent	Percent
Sept. 6	81	72	90
12	83	74	94
21	68	76	5
29	76	70	20
Oct. 4	71	78	25

Early seasonal appearance of wireworm adults in Pacific Northwest.---M. C. Lane, of the Walla Walla, Wash., laboratory, reports: "The abnormally mild weather has resulted in exceptionally early appearance of the elaterid beetles. A heavy flight of Pheletes canus Lec. males occurred shortly after the middle of March, though soil temperatures were not such as to cause many females to emerge. A few specimens of other species have been seen, the most important being Pheletes californicus Mann., Limonius infuscatus Mots., two species of Cardiophorus, and Melanotus oregonensis Lec. The host relationship of the adults is upset since both pear and cherry trees are in full bloom now, whereas the flight of female P. canus has not begun, yet it does not seem possible that the flight of the latter can be delayed until the flower heads of the rhubarb have developed. The bloom of the pear, cherry, and rhubarb have, in previous years, been the most important sources of food for the adults of P. canus. A new host relationship may develop this season, as a result of abnormal seasonal conditions."

Role of temperature and moisture in naphthalene fumigation for wireworms.---As a result of experiments to determine the efficiency of naphthalene as a soil fumigant at Walla Walla, Wash., R. S. Lehman reports that there was no significant difference in wireworm mortality in soils where the moisture varied from 8.52 to 28.64 percent, and there was practically no difference in wireworm mortality at 15° C. (59° F.) and 25° C. (77° F.) in a 48-hour exposure period. In a 24-hour exposure period the mortality at 25° C. was much greater than at 15° C. When fumigation with naphthalene takes place in the field the conditions are very different than in the laboratory. In the laboratory the naphthalene and wireworms are confined in a closed space with no chance for escape of either. If the period of exposure is long enough, a sufficiently high concentration of the gas is built up to kill the wireworms, even at a fairly low temperature. In the field the case is somewhat different. If a small quantity of naphthalene is used at a high temperature the gas escapes from the soil before a lethal concentration is reached. If a large quantity is used at a low temperature the same thing will occur, that is, the naphthalene will escape from the soil gradually as it slowly vaporizes and before a lethal concentration is reached. Therefore, the amount of naphthalene must be such that at a temperature of 20° to 25° C. (68° to 77° F.) a lethal concentration is built up rapidly. From past experience in the field it appears that the correct amount is about 800 pounds per acre. The species of wireworm involved was Pheletes canus Lec.

Depth planting as a factor in reducing narcissus bulb fly infestation.--C. H. Martin, of the Sumner, Wash., laboratory, reporting on the results obtained in some experiments in depth planting, says that "the infestation of Merodon equestris Fab. was determined in two plantings of King Alfred narcissus bulbs, one plot being planted at a depth of 4 inches and the other 8 inches deep. Otherwise the two plots, which were within 400 feet of each other, were comparable for the various factors which affect infestation by this pest. One thousand bulbs from the plot planted 8 inches deep had an infestation of 1.2 percent, while one thousand bulbs from the plot planted 4 inches deep had an infestation of 14.4 percent. (These data corroborate similar results obtained at Babylon, L. I., N. Y., in connection with Eumerus spp.) From this evidence it appears that deep planting is a factor of considerable importance in reducing Merodon infestation.

Spring populations of beet leafhopper low in Modesto area.--W. C. Cook, of the Modesto, Calif., area, reports as follows: "The numbers of beet leafhoppers (Eutettix tenellus Bak.) produced in the spring generation were the lowest we have recorded. Several factors contributed to this. Because of the late germination of annuals, the leafhoppers were forced to remain on perennials longer than usual. R. A. Fulton, Twin Falls, Idaho, has determined that when feeding on perennials the overwintering leafhoppers draw upon their fat reserve, and this undoubtedly was considerably reduced this year, reducing the egg-laying capacity of the beet leafhoppers. In the north end of the area the weather was favorable for a rank growth of the host plants, a condition unfavorable for production of leafhoppers. In the southern part conditions were reversed, and in many places host plants dried up before the eggs were laid. While the unusually warm weather in March hastened the development of the spring generation, the sudden drying of the host plants in the latter part of the month prevented the maturing of the later nymphs and, over a large part of the area, practically eliminated the chances of a partial second generation in the foothills. There is some evidence that this partial second generation normally occurs.

Spring host plant studies in Modesto, Calif., area.--As a result of observational and experimental studies conducted by W. C. Cook and his associates at the Modesto laboratory, on the relative importance of certain of the wild host plants of the beet leafhopper, conclusions have been drawn which are summarized as follows: "(1) The favorableness of plant species as hosts depends upon the other plant species present; for instance, Plantago shows up as a favorable host when present without Lepidium, but where the two occur close together, Plantago becomes unimportant. (2) Red stem filaree (Erodium cicutarium) is not an important host, the number of first-instar nymphs found on a sample being in direct proportion to the number of plants of Plantago, Lepidium, or other species present. (3) Calandrinia

under certain conditions may be a good host. In collecting plant samples from an area where nymphs were found for a comparison of numbers of nymphs emerging from each plant species, more nymphs were obtained from Calandrinia than from all other hosts combined. (4) The varying favorableness of a plant species from year to year may depend upon the stage of development of that species at the time the overwintering leafhopper females begin to lay eggs. This development may vary from year to year, depending upon the time of germination and type of season. Thus in one year Lepidium may be in the proper stage for oviposition when the females are ready to lay eggs, whereas in another year this species may be too far advanced to be attractive for oviposition."

High recovery of beet leafhoppers from hibernation cages at Twin Falls, Idaho.--The recovery of E. tenellus from hibernation cages was greater during the winter of 1933-34 than had been the case the previous season (1932-33). These leafhoppers were collected from dead or almost dry Salsola pestifer during the last week of September and the first week in October, and caged immediately on Salsola parviflora. The following tabulation shows the mortality of both male and female E. tenellus in the cages at Twin Falls as indicated by recoveries made at various periods throughout the past winter season:

Date of recovery	Females			Males		
	Caged	Recovered	Mortality	Caged	Recovered	Mortality
	Number	Number	Percent	Number	Number	Percent
Dec. 6, 1933	1,000	753	24.70	300	141	53.00
Jan. 3, 1934	1,000	687	31.30	300	51	83.00
Feb. 2, 1934	1,000	526	47.40	300	28	90.67
Mar. 2, 1934	1,900	591	68.89	570	37	93.61

The foregoing data show a high initial mortality of females of E. tenellus during the fall months, even though the host conditions within the cages were generally excellent. This in all probability can be attributed to the poor condition of the leafhoppers themselves, for they had spent the late summer and early fall months on S. pestifer that was in a continual state of drying. The sudden transfer to green and succulent S. parviflora must have offered considerable shock to them and probably caused a good share of the relatively high initial mortality.

Thirty male E. tenellus were placed in each cage along with the females, and, although the mortality was great, it was less than in former years. The foregoing tabulation shows that a relatively high percentage of males was recovered on December 6 and that, even though the numbers became progressively less, as the season advanced, a few were found in the cages as late as March 2.

Ten additional cages were set up at the same time (September 28 to October 10) with 100 male E. tenellus in each for the purpose of determining the survival of these in comparison with females similarly caged. From these cages a total of 95 males were recovered, giving a mortality of 90.5 percent. This unusual occurrence of the survival of even a relatively small percentage of E. tenellus in cages located at Twin Falls and the three regional plots (Castelford, Burley, and Wendell) is recorded in tabular form as follows:

Hibernation-cage recovery of Eutettix tenellus on February 27 to March 2, 1934

Locality	Females		
	Caged	Recovered	Mortality
	Number	Number	Percent
Twin Falls	1,900	591	68.89
Burley	2,000	646	67.70
Wendell	1,900	798	58.00
Castleford	1,900	1,190	37.40

The foregoing summary, taken from observations by D. E. Fox, of the Twin Falls, Idaho, laboratory, shows a relatively high recovery from the cages in all these localities, with the average mortality highest at Twin Falls and lowest on the Castleford plot.

Conditions favorable for high populations of beet leafhopper in Salt Lake City area.--E. W. Davis, of the Salt Lake City, Utah, laboratory, reports as follows: "In a check we find rather high populations (of E. tenellus) from Nephi north. At Elberta 5 females were found in 50 sweeps; at Pelican Point, just west of Utah Lake, 9 in 50 sweeps; in Tooele Valley, 8 in 50 sweeps; at Grantsville, 12 in 50 sweeps; and at Magna, 4 in 50 sweeps. This year E. tenellus overwintered in an area where it had not been found to overwinter since 1927. We are finding E. tenellus over practically the entire distance from Salt Lake south to the south end of the beet-growing area in Sevier Valley. Normally we do not find any E. tenellus overwinter in Sevier Valley, and very few in the area around Salt Lake. The area of host plants that have survived the winter extends over practically all the area from Salt Lake to the south end of Sevier Valley. This is another condition that has not previously been found. As a rule no winter host plants have been found south of Nephi. The area of host plants in the Magna breeding area this year is larger than in previous years and the mild temperature has permitted the E. tenellus to go through the winter with less than normal mortality."

Strawberry weevil emergence delayed in South.--W. A. Thomas, of the Chadbourn, N. C., laboratory reports as follows: "The unusually cold and prolonged winter in the Chadbourn, N. C., area caused much of the native vegetation to be greatly delayed in blooming. This was especially true of the native host plants of the strawberry weevil (Anthonomus signatus Say). Huckleberry, the earliest of the native host plants, usually begins showing open flowers the latter part of February or the first of March. Ordinarily, within a week or 10 days the weevils are feeding on these plants. During the present season no blooming of huckleberry took place until March 20, and then only one or two flowers per plant could be found. Careful observation showed that on these few open flowers the strawberry weevils were beginning to concentrate. The evidence seems to indicate that the weevils began emerging from hibernation a few days prior to the opening of the first flowers on huckleberry, but were not attracted to these plants until open flowers appeared. The infestation of huckleberry flowers, under ordinary spring conditions, takes place rather slowly, unlike the present rapid concentration on these plants. The second earliest host plant in the Chadbourn area, chokeberry, begins blooming March 27, at which time the weevils were just entering the strawberry fields. There is no evidence to show that the low temperature of the past winter affected hibernating weevils adversely."

Important economic loss caused by lima bean pod borer.--During a survey of warehouses receiving lima beans in the counties of San Diego, Orange, and Ventura, Calif., Rodney Cecil, of the Ventura laboratory, reports an estimated loss of $90,000 as a result of injury by the lima bean pod borer (Etiella zinckenella Treit.), plus the cost of removing damaged beans from the marketed product. A total of 261,000 hundred-pound sacks of lima beans were involved in this survey. The average percentage of beans damaged by the borer ranged from 0.5 to 3.5 in the 16 warehouses examined.

Phlox bug overwinters in egg stage.--H. H. Richardson, of the greenhouse insects laboratory, Washington, D. C., reports that recent studies at Arlington Farm, Va., have revealed that the phlox bug (Lopidea davisi Knight) overwinters in the egg stage, as suspected by previous investigators of the biology of this insect. The eggs were found inserted in the lateral buds of the old phlox stalk, and during the past winter such eggs survived exposure to a minimum temperature of -6.5° F. It is apparent that clean-up measures of old phlox stalks in the autumn or winter should prove effective in controlling the insect, especially when the stalks are cut at the ground level.

Observations on resistance of red spider to hot water.--F. F. Smith, of the greenhouse insects laboratory, reports that "In the course of contemplated control studies for the cyclamen mite (Tarsonemus pallidus Bks.) on gerbera, to be conducted at Babylon, N. Y., by means of hot water, the grower desires to know whether the same treatment will also control the common red spider (Tetranychus bimaculatus Harvey). In one series of tests with water at 110° F., the red spider was not killed by a 50-minute or shorter immersion. Apparently adult females were killed by a 30-minute or longer treatment. The eggs are evidently more resistant than are the other forms. Although the observations on the resistance of the various stadia are not extensive, the test indicates that hot-water treatment will not rid most growing plants, including the highly tolerant gerbera, of red spiders.

Vacuum fumigation with ethylene oxide-carbon dioxide mixture effective against cigarette beetle.--W. D. Reed, of the Richmond, Va., laboratory, reports that in recent vacuum fumigation tests with the ethylene oxide-carbon dioxide mixture (carboxide) a mortality of 100 percent of the cigarette beetle (Lasioderma serricorne Fab.) in Turkish tobacco was obtained. In these tests a dosage of 46 pounds of the fumigant were used per 1,000 cubic feet, with exposures ranging from 3 to 3½ hours. Samples of infested Turkish tobacco fumigated with this same mixture by a large commercial firm were submitted to Mr. Reed and his associates for examination and it was found that 100 percent mortality of the beetle had been obtained.

A simple date finder or calculator to determine calendar intervals.--To expedite the routine process of ascertaining calendar intervals in determining duration of life-history stages and similar entomological phenomena, Rodney Cecil, of the Ventura, Calif., laboratory recently submitted an article detailing the construction of a home-made device, consisting essentially of two machined and numbered disks, which by proper manipulation added accurately and rapidly the duration of any calendar period up to and including 365 days. This article was intended for inclusion in the Entomological Technique series, but before publication (and unknown to Dr. Cecil) this same idea appeared in a supplement to The Gladiolus Review of January 1934, under the name of the "Cantelo date finder," for use in determining the blooming dates of gladiolus and other bulbs, of which the period from planting to flowering was known. This chart was originated by Walter Cantelo, of Hoosick, N. Y., who passed the copyright to the American Gladiolus Society at Goshen, Ind.

Special committee organized to combat the vinegar gnat.--At a meeting of the Tri-State Packers' Association, Baltimore, Md., on April 10, a special committee was organized to develop control methods for the elimination of maggots of the vinegar gnat (Drosophila

melanogaster Meig.) in canned tomatoes. Preliminary plans indicated two major phases of activity, including, first, the biological studies to determine more definitely the habits of the insect; and, second, the mechanical improvements in the field and in the factory that will be necessary to eliminate the maggots from the canned product. With Dr. E. N. Cory, of the University of Maryland, as chairman, the committee consists of members of the Tri-State Packers' Association, entomologists, and representatives of the boards of health of the three States concerned, together with members of the U. S. Department of Agriculture.

FOREST INSECTS

New predator on mountain pine beetle.--W. D. Bedard, of the Coeur d'Alene, Idaho, field laboratory, reports that the larvae of an anthomyiid (Phaonia, n. sp.) are predacious and feed mostly on larvae of the mountain pine beetle. This fly has a 1-year life cycle with no apparent variations. Adults are most abundant during July, at which time the eggs are laid. Larvae are found only in the trees attacked by D. monticolae during June, and are most abundant on the moist underside of windfalls. The winter is passed beneath the bark of these trees as mature larvae, and pupation takes place during the following May and June. The average length of the pupal stadium was 23 days for 21 larvae reared in the laboratory.

Insects associated with Oregon pine bark beetle.--H. J. Rust, of the Coeur d'Alene, Idaho, field laboratory, who is bringing to a close intensive life-history studies of Ips oregoni Eich. conducted during the last three field seasons, reports a large number of insects associated with this bark beetle. A total of 110 species are listed, which are grouped as follows: Coleoptera, represented by 84 species; Hymenoptera, 9; Hemiptera, 8; Diptera, 6; and Arachnida, 4. Arachnida rank first in order of importance, with two egg-destroying mites, and Hymenoptera next with two very beneficial parasites, Pachyceras eccoptogastri Ratz. and Coeloides dendroctoni Cush. The combined feeding activities of all parasitic and predacious associates throughout the season reduce the potential broods of the Oregon engraver beetle from 80 to 85 percent.

Past winter favorable to bark beetles in California.--Specialists at the Berkeley, Calif., field laboratory report that during the winter of 1932-33 there were low temperatures that resulted in the highest kill of bark beetle populations ever recorded in California. In contrast, the winter of 1933-34 has been extremely mild with no cold spells even approaching the lethal temperatures for overwintering broods of the mountain pine beetle and western pine beetle. Temperatures above normal have stimulated development, with the result that by the middle of March broods in all localities are very far advanced for the season. A recent survey of General Grant Park by D. DeLeon

of the National Park Service indicated that many new adults of the mountain pine beetle will soon be ready to emerge from infested sugar pines in that area. Broods of the western pine beetle are estimated to be from 2 to 3 weeks farther advanced than at the same date last year. Snowfall has also been extremely light, with the result that it has been possible to keep control work going practically throughout the winter. Two projects in northern California, one on the Modoc and another on the Lassen National Forest, were started early in December and completed about March 1. Two large projects in central California, involving treatment of areas in the Yosemite National Park and in Stanislaus National Forest, were closed down late in December in anticipation of heavy snowfall which is usual in this part of the Sierras. A very light precipitation occurred, however, and control work was resumed soon after February 1. These projects are now well along toward completion. It is considered desirable to complete all control work in the State by April 5, as it is expected that emergence of the beetles may be under way by that time.

Mountain pine beetle produces two or more seasonal generations in sugar pine.--A report has recently been completed by G. R. Struble, of the Berkeley, Calif., field laboratory, summarizing the seasonal and life-history studies of the mountain pine beetle in sugar pine, which have been carried on during the past 2 years. In the central Sierra region of California it has been found that this insect produces two complete seasonal generations and a partial third. In the white pine region of northern Idaho the same species produces but one complete seasonal generation. In its California habitat this insect differs in other respects from the northern form. One important difference which was determined recently at the Berkeley laboratory is that of cold resistance of the larval form. Overwintering larvae collected from sugar pine in central California were killed by cold at temperatures from 12° to 7° above zero F.; those collected from white pine in northern Idaho were not killed until subzero temperatures were reached, complete mortality occurring between -2.5° and -17.5° F.

Toxicity of bark-penetrating oils dependent upon temperature.--Field experiments carried on during the seasons of 1932 and 1933 at the Berkeley, Calif., field laboratory with light mineral oils of kerosene base as a means of killing western pine beetle broods in the bark of ponderosa pine resulted in wide variation in the percentage of kill. The best results were obtained during periods of warm weather, indicating that toxicity of the oils had some relation to temperature.

To determine this relationship experiments were recently carried out at the Berkeley laboratory. Bark samples containing larval broods of the western pine beetle treated with varying classes of oil were exposed in special chambers in which the temperature, humidity, and air circulation were under control. It was found that from 1 to 3 weeks' exposure produced no effective killing at temperatures below 50° F., regardless of quantity of oil used. From 50 to 55 percent of the larvae were killed with normal dosage with 1 week of exposure at temperatures of 60° to 65° F. At 70° to 90° F. high mortality occurred, ranging from 67 to 93 percent with light dosage to practically 100 percent with heavy dosage of the oil. It was also found that bark which had been kept for 3 weeks at temperatures below 50° F. still retained sufficient oil to produce high mortality when exposed to temperatures within the killing range. This indicates that when bark is treated in the woods during periods of cold weather it will retain sufficient oil in toxic quantities to insure appreciable killing if warm temperatures occur later. As development of western pine beetle larvae does not progress below temperatures of 50° F., the broods in the treated bark will remain dormant until temperatures reach the range in which the oil becomes effective. Regardless of the temperature conditions under which oil is applied, results become effective before emergence occurs.

Mortality of gypsy moth eggs due to cold.--Early in January the Melrose Highlands, Mass., laboratory collected egg clusters of Porthetria dispar L. from seven Massachusetts towns to obtain information on the effect of the unusually low temperatures of late December on the hatching of the eggs. The egg clusters were isolated in glass vials in the laboratory, the number of larvae that issued from each was recorded, and when hatching was over the unhatched eggs were examined under the microscope to determine the number that were fertile, the number infertile, the number containing living larvae of the egg parasite Anastatus disparis Ruschka, and the number in which the parasite was dead. J. E. R. Holbrook has completed this work and presents the information in the following tabular form:

Town	Lowest temperature	Egg clusters	Total fertile eggs	Fertile eggs that hatched	Egg clusters giving caterpillars	Anastatus living
	°F.	No.	No.	Percent	No.	Percent
Clinton, Mass.	-19	20	8,277	34.92	20	77.51
Concord, "	-24	20	4,195	3.36	4	9.44
Fitchburg, "	-14	20	3,168	25.10	12	36.66
Hyannis, "	- 9	19	6,662	78.62	20	90.55
Middleboro,"	--	20	6,859	5.05	4	4.02
Plymouth, "	-11	20	10,937	34.47	20	90.37
Saugus, "	--	15	8,334	54.51	12	52.41

It will be noted that there is a relation between the percentage of Anastatus living and the eggs that hatched in the various collections. The temperatures given are the lowest reported by the Weather Bureau for towns in which collections were made. They do not, of course, necessarily indicate the lowest temperature to which the eggs were exposed.

Other collections of gypsy moth egg clusters were later received from Maine, New Hampshire, Vermont, Massachusetts, and Connecticut to determine further the effects of the low winter temperatures. While a final report on these collections can not be made at this time it is evident that the percentage of fertile eggs dead is higher in some collections than in any of those referred to above, particularly in collections made in parts of Maine, New Hampshire, and Vermont where colder temperatures occurred.

Mortality of European pine shoot moth due to low temperatures.--J. V. Schaffner, Jr., of the Melrose Highlands, Mass., field laboratory, reports concerning collections of larvae of Rhyacionia buoliana Schiff. obtained from the field this winter and examined by him and C. L. Griswold to determine how many of the larvae were dead. Late in January collections of infested pine tips from four localities in New York were received from H. L. McIntyre, of the New York Conservation Department. The numbers of larvae in these lots of material and the percentages found to be dead were as follows:

Locality	Total larvae	Larvae dead
	Number	Percent
Cross River, N. Y.	36	91.6
Kensico Dam, N. Y.	39	61.5
Syosset, N. Y.	48	27.0
Jericho, N. Y.	35	65.7

In view of the fact that there was another spell of unusually cold weather in February it was decided to make further examinations of infested material. Additional collections were received from New York and some were made in the vicinity of Boston. The results of the examination of this material are given below:

Locality	Total larvae	Larvae dead
	Number	Percent
Cross River, N. Y.	40	100.0
Kensico Dam, N. Y.	39	92.3
Syosset, N. Y.	58	70.6
Jericho,N. Y.	131	87.0
Winchester, Mass.	66	100.0
Belmont, Mass.	37	91.3
Newton, Mass.	38	94.7

The collections from Belmont and Newton, Mass., were from Mugho pine and many of the infested tips were taken within a foot of the ground where they were probably protected by snow during part of the winter. In most of the collections a few of the dead larvae were dry or moldy, indicating that they died before the low temperatures occurred, but it seems safe to assume that at least most of the others were killed by the low temperatures.

Scolytid beetles continue breeding under bark.--W. J. Buckhorn, of the Portland, Oreg., field laboratory, contributes the following: "Bark beetles usually work for a single season in freshly killed trees, therefore the repeated breeding under dry bark is a most remarkable habit. Emergence of Carphoborus blaisdelli Sw. from a small section of sugar pine during the past month makes the fourth year of emergence from this specimen. A small section, 3 inches in diameter and 20 inches long, from the top of a young sugar pine was collected in June 1930, at which time it was just being attacked. The first emergence occurred in April 1931, and since that time whenever temperatures were favorable emergence has continued. Each year the number of adults emerging has increased approximately six times, with 16 beetles in 1931, 99 in 1932, and 664 in 1933, or a total of 779 beetles. The 1934 emergence is now well under way and several hundred beetles have already emerged. The bark of this small specimen is now a paper-thin shell, and everything underneath down to the hard wood has been completely reduced to powder.

When do Douglas fir snags fall?--J. A. Beal, of the Portland, Oreg., field laboratory, reports that shortly after the close of the Civil War a tremendous forest fire swept over thousands of acres of virgin Douglas fir timber in Columbia County, Oreg. Now, almost 70 years later, this area is partially restocked with young growth ranging in age from 1 to 50 years. Thousands of standing snags scattered over the area still remain, mute evidence of the disastrous fire. Some of these snags are still sound enough to be used for lumber. Many more are still highly desirable for fuel wood. The

work of insects and decay is crumbling many from the tops downward, but a large number of them will undoubtedly remain standing for many more years—a serious fire menace to the associated young growth. This area was examined during the study on deterioration of fire-killed Douglas fir.

Experiments in injection of fire-killed Douglas fir.--With the idea of lengthening the life of the fire-killed Douglas fir on the Tillamook burn, an interesting set of experiments were conducted during the past 4 months by J. M. Whiteside of the Portland, Oreg., field laboratory, and have recently been completed. Using a strong solution of mercuric chloride to preserve the wood from the deterioration wrought by wood-boring insects and fungi, five series of tests, using 23 Douglas firs varying in condition from green and healthy to those badly burned in the history-making forest fire of August 1933, have been made. In spite of the fact that the rise of sap and opening of the buds of Douglas fir occurred a month early, following an extremely mild winter which established new climatological records for this section, the trees did not readily absorb the preserving solution. The height reached in the green check trees was very small, compared with the total height of the trees, and almost negligible in the burned trees. Had these tests been made shortly after the burning of these trees and during a period of low humidity and high temperature, better results might have been obtained.

Caging experiments summarized.--A progress report by W. J. Buckhorn, of the Portland, Oreg., field laboratory, on the Ochoco caging experiments conducted last season, has been completed during the month and is now being typed. A compilation of the data brought to light many little known and interesting habits of some of the common insects inhabiting ponderosa pine, besides giving important data on the seasonal history of the western pine beetle.

For instance, the different insects show a marked difference in their periods of emergence. Most of the species emerged in early summer but some did not emerge until late in the season. Trypodendron ponderosae Sw. was one of this type with 94 percent of the emergence occurring between October and December 7. Many species emerged during warm days in the middle of winter. The most prominent of these was Rhizophagus sculpturatus Mann. and Ips emarginatus (Lec.). More than one adult of Dendroctonus brevicomis Lec. may use the same exit hole upon emerging, and in one instance 53 percent more beetles emerged than there were exit holes.

CEREAL AND FORAGE INSECTS

Morphology of the wheat joint-worm gall.--W. J. Phillips and F. F. Dicke, Arlington Farm, Va., report that "the main features of the study of the morphology of the gall caused by Harmolita tritici Fitch in the stems of wheat have just been completed and some interesting and important facts have been discovered. This investigation covers the period from deposition until the larvae become full grown. The reactions of the plant tissues to the eggs and larvae were studied by means of transverse and longitudinal microtome sections cut through the gall area. Eggs are deposited in the meristematic region of the nodes. Oviposition does not ordinarily take place unless nodes are present in the early meristem stage. When oviposition does occur in older and harder tissue, the larvae do not reach maturity. This is a very important point and has a practical application. It is undoubtedly possible to so accelerate the growth of wheat, by fertilization and cultural practices, that it would be unattractive for oviposition when the adult jointworm emerges. Should this not always be practical, the galls would at least be located so high on the stem that they would be removed by the binder and the danger of reinfestation be thus overcome. The tissues of the wheat plant react violently to the presence of the eggs and larvae of the joint worm. The cells in the region of the larvae lose their polarity, increase greatly in number and size, and lose their power to differentiate into normal tissues. Therefore, no supporting tissue is developed in this region and that explains why the infested culms become weakened and many of them fall. The cells in the gall areas are apparently not activated by any secretions introduced with the egg at time of oviposition. The stimuli apparently arise from the mechanical irritation of the tissues and from the byproducts of metabolism of the larvae.

Wheat stems, at the proper stage of development for oviposition, were taken from a point in the wheat belt of Kansas and compared with plants in a similar stage of development from Indiana and Virginia. This study disclosed the fact that the meristematic regions of the plants from Kansas would not be acceptable for oviposition. Should eggs be deposited, the probabilities are that the larvae would never reach maturity. This is perhaps the reason why H. tritici has never spread into the Wheat Belt of the Middle West. Whether the difference in the meristematic regions observed in the Kansas plants from those in Indiana and Virginia was due to varietal characters or to climatic conditions has not been ascertained. The detailed results of these investigations will be put into manuscript form at an early date.

Subtropical leafhopper a pest in Washington, D. C., greenhouse.—W. H. Larrimer, Arlington Farm, Va., reports as follows: "With further reference to the occurrence of Peregrinus maidis (Ashm.), in a greenhouse at Columbia, Mo., as reported in the February Monthly Letter of the Bureau of Entomology by P. W. Oman of the Division of Identification and Classification of Insects, F. W. Poos reports that he found this species breeding abundantly in May 1928 on teosinte in a greenhouse of the Department in Washington. Spraying was necessary in order to prevent destruction of the plants by this species, specimens of which are still available. The identification of this material was verified by Dr. Herbert Osborn."

Armyworm overwinters successfully; army cutworm moderately abundant in alfalfa.--H. H. Walden, Wichita, Kans., reports the occurrence of the armyworm (Cirphis unipuncta Haw.) on March 16, at the average rate of 10 larvae per clump of volunteer wheat examined. All were in the larval stage, 33 percent being in the fourth instar, 55 percent in the fifth instar, and the remainder in the last (sixth or seventh) instar. This indicates successful wintering for this species in the Wichita area and suggests possible outbreaks later in the season, although there is some parasitization, 4 percent yielding parasites up to March 30. The army cutworm (Chorizagrotis auxiliaris Grote) was moderately abundant in a few fall-sown alfalfa fields during March and has been reported in the press as being responsible for damage to alfalfa probably caused mainly by the corn ear worm (Heliothis obsoleta Fab.), which extensively injured young alfalfa in the fall of 1933. Mortality in army cutworms collected about the middle of March has been 13 percent from parasites and 25 percent from disease.

Grass hosts of Hessian fly reflect general scarcity of fall-generation fly.--According to E. T. Jones and J. R. Horton, Wichita, examination of 7,995 culms of 5 species of grass ordinarily infested by the hessian fly collected in wheat fields during March did not yield a single infested stem. Examination of about half as much material of these same 5 species of grass last year yielded substantial infestations in every one. This suggests the possibility that these grasses either were not available or were not suitable for oviposition when the bulk of the flies emerged in the fall of 1933. This possibility should be investigated.

Chinch bug migrating from volunteer wheat.--W. T. Emery, Wichita, reports that a continued study of Blissus leucopterus Say in winter quarters during March indicated that there was a gradual thinning out of the bugs in clumps of volunteer wheat, whereas there was no shift in the population in Andropogon sod. Temperatures taken in the

latter registered 17° to 19° cooler than the corresponding air temperatures and, while no temperatures were taken in volunteer wheat, those in drilled wheat were only 7° to 9° lower than the corresponding air temperatures.

Alfalfa weevil oviposition unusually early.--Geo. I. Reeves, Salt Lake City, Utah, reports that "Owing to the absence of any winter weather, the oviposition of Hypera postica Gyll. is many weeks in advance of its usual schedule at Medford, Oreg., Fallon, Nev., and points in northern and central Utah, the only places where damage is anticipated. The weather next month will largely determine whether this situation leads to an overwhelming attack upon the crop, or an attenuation of the egglaying and therefore a reduction of the damage."

Recovery and colonization of Bathyplectes curculionis in Alameda County, Calif.--W. B. Cartwright of the Sacramento, Calif., laboratory reports regarding this parasite of the alfalfa weevil: "Three cocoons of 1934 origin were found at Pleasanton on March 26. These represent the recovery from a single May-to-June colonization of 1933 composed of 123 males and 248 females introduced from Nevada. Two additional colonies of 1933, at Pleasanton, are probably lost by plowing the alfalfa fields during the winter. The major colony at Pleasanton was increased by further liberations in March, and two additional colonies were started at Niles. The weather has been favorable for introductions, and the weevil populations are good.

Grasshoppers hatch early and outbreaks in California are probable.--C. C. Wilson, Sacramento, states: "Joseph Keyes, of the Bureau of Biological Survey, reports to this office that grasshoppers were hatching in Santa Barbara and San Diego Counties, Calif., near the end of March. Considerable numbers of nymphs were noted in the dry-land areas of Santa Barbara County, and the premature dying of the vegetation, due to low rainfall, is expected to force an invasion to adjacent cultivated areas. Eighteen tons of bran were used in 1933 in control. A more severe outbreak is predicted this year. The hatching of grasshoppers in San Diego County is a month earlier than last year, and a serious outbreak is thought to be pending. No hatching of grasshoppers has been noted at Sacramento and only minor development of the embryos in the eggs. Northward, at Bieber, hatching was reported on March 28."

Toadflax serves as emergency ration for corn earworm.--Geo. W. Barber, Savannah, Ga., reports as follows: The place occupied by an unimportant wild plant in the life history of an injurious insect is well illustrated by the plant Linaria canadensis (L.) Dumont. In the last week of March this plant was blooming on grass lands and fallow ground in nearly solid stands. It matures its seed by the first of June and is seen no more during a season. It is the first plant of

the season to serve as food for larvae of Heliothis obsoleta and Heliothis virescens Fab. Both of these larvae feed on the green seed capsule of toadflax in the early spring. Moths of each species emerge from hibernation before any of the usually favoured cultivated plants are available as food for larvae. Many of the progeny of these moths feed on Linaria seed pods, passing through a first generation of the year on this wild plant. Thus, this wild plant, usually very abundant from the last week of March until the first of June, serves to fill in a blank period as far as cultivated crops are concerned, and tides these insects over until more favored and cultivated plants are suitable and abundant in the field. Linaria canadensis, while usually thought of as an unimportant weed, is thus found to be of considerable economic importance in the seasonal history and control of the injurious insects mentioned.

Correction.--The species of Crotalaria mentioned on page 9 of the September 1933 Monthly Letter as C. spectabilis as attacked by the three-lined blister beetle (Epicauta lemniscata (Fab.)) should have been C. intermedia. The former species was not attacked.

COTTON INSECTS

Committee surveys Division of Cotton Insects.- The committee appointed by Mr. Strong to make a survey of the work of the Division of Cotton Insects consisted of W. E. Hinds of Louisiana, Z. P. Metcalf of North Carolina, S. Marcovitch of Tennessee, and M. S. Yeomans of Georgia. This committee met at Tallulah, La., on February 26 and spent 3 days in conferences with workers at that place. During the next 2 weeks the committee conferred with all station and project leaders and with practically every worker in the Division. The field stations at College Station, Port Lavaca, and Presidio, Tex., were visited in company with F. L. Thomas of the Texas Experiment Station. At Tucson, Ariz., besides conferring with this Bureau's workers, conferences were held with the officials connected with the State of Arizona and of the Bureau of Plant Quarantine. At Presidio two official entomologists from Mexico and several of the Bureau of Plant Quarantine workers participated in the conference. The committee completed its report at the San Antonio Office of the Bureau of Plant Quarantine. Four small stations of the Division were not visited but the committee conferred with the men in charge of each. F. F. Bondy, of Florence, S. C., met the committee at Tallulah, La.; H. C. Young, of Eufaula, Okla., met the committee at College Station, Tex.; T. C. Barber of Brownsville, Tex., was at Port Lavaca; and C. S. Rude, of Tlahualilo, Mex., was at Presidio. The 17-page report submitted to Mr. Strong showed a thorough study of the work of the Division and contained helpful suggestions.

Boll weevils on flight screens during winter.--G. L. Smith, of the Tallulah, La., laboratory, has for several years been studying the winter movement of boll weevils (Anthonomus grandis Boh.) by flight screens. Standard size (3' x 5') screens, coated with tanglefoot, are located in several fields and the insects removed at regular intervals. The following table lists the number of screens in use and the number of weevils taken during January, February, and March for the past 3 years:

Month	Boll weevils collected		
	1932	1933	1934
	Number	Number	Number
January	207.0	6.0	11.0
February	175.0	1.0	3.0
March	223.0	9.0	6.0
Total	605.0	16.0	20.0
Number of screens	26.0	20.0	9.0
Average per screen	23.3	0.8	2.2

There is considerable correlation between the records obtained from the flight screens and those obtained from the hibernation cages and Spanish moss examinations at Tallulah. All three indicate more winter activity of boll weevils in 1934 than in 1933 but much lower than in 1932, as is shown in the following tabulation:

Year	Live weevils per ton of Spanish-moss in March	Active weevils in cages during January, February, and March	Weevils caught per screen during January, February, and March
	Number	Number	Number
1932	462.3	365	23.3
1933	1.3	19	0.8
1934	40.2	40	2.2

Correlation between boll weevil development and mean temperature.--T. C. Barber, Brownsville, Tex., has been rearing boll weevils throughout the winter from field-collected cotton squares. The lower part of the Rio Grande Valley is probably the only locality in the United States where a continuous supply of infested cotton squares would be available to the boll weevil under natural conditions throughout the winter. From his studies of boll weevil development during the winter of 1933-34, Mr. Barber draws the following conclusions:

"1. If the mean temperature falls as low as 52° F., there will be no weevil emergence until the temperature again rises.

"2. If the minimum temperature falls as low as 40° F., there will be no weevil emergence the following day, even though the maximum temperature should rise sufficiently to raise the mean temperature as high as 59° F.

"3. If the mean temperature falls as low as 60° F., or lower, accompanied by a drop in relative humidity to 50 percent or less, there will be no weevil emergence.

"4. But with a mean temperature of 55° F., and a relative humidity of 80 percent, a slow emergence of boll weevils will continue, indicating slight weevil activity.

"5. Irrespective of relative humidity, it is definitely indicated that a mean temperature of about 54° F. is the teetering point of boll weevil activity, with the percentage of relative humidity acting as the balancing medium. With a high percentage of relative humidity at this point there will be slight weevil activity; with a low percentage of humidity there will be no activity."

Notes on cotton flea hopper.--K. P. Ewing, Port Lavaca, Tex., reports that the first cotton flea hoppers (Psallus seriatus Reut.) hatched on February 12 from overwintering eggs in stems of plants placed in hibernation cages. This is two days earlier than in 1933; however, the hoppers did not appear in numbers until about the middle of March, which is considerably later than last year and is due to the cooler weather this spring. The mean temperature this March was 4.83° F. lower than in March 1933. The first nymph found in the field was of the second instar and was taken on March 6. Field inspections show that the flea hopper nymphs are very scarce, as compared with the number present at this time last year. Horsemint, a favorite spring host plant, sprouted early but because of the cold weather has made very slow growth. Croton plants are scarce and also very small, as compared with last year.

T. C. Barber reports that he has been unable to find any flea hoppers at Brownsville, Tex., since November, and very few since the September hurricane. There is now an abundance of horsemint and other host plants in bloom and in previous years hoppers have invariably appeared on mint plants prior to this time. Also during other winters we have been able to collect occasional specimens upon Tidestromia lanuginosa, but for some reason this plant was not present during the past winter, dying away in November when it should have been starting its seasonal growth. There seems to be some connection between the hurricane of last fall and the absence of cotton flea hoppers this spring, as many other plants have been thrown "off season" in the same manner as the Tidestromia plants mentioned.

E. W. Dunman reports that flea hopper nymphs were not found in the vicinity of Bryan, Tex., until the last few days of March, which is late for that section. On March 30 the croton plants were just breaking through the ground in some areas and nymphs in the first and second instars were observed feeding on these young, tender plants. The delayed emergence means that the early nymphs will find suitable wild food on which to feed and the bulk of the pppulation will emerge at a time when cotton is available. The Agricultural Experiment Station at College Station, Tex., has issued a press release on the flea hopper outlook, advising growers that only a small proportion of the large number of eggs present this year had hatched by the end of March and that this delayed emergence of the hoppers usually means serious damage to early cotton.

Pink bollworm parasites.--L. W. Noble and S. L. Calhoun, Presidio, have been breeding Exeristes roborator Fab. on pink boll worms (Pectinophora gossypiella Saund.) in infested cotton locks instead of removing the worms, killing them in hot water, and placing them in corn-stalk piths for oviposition, as in the original technique. A total of 1,959 parasites, of which 29.5 percent were females, have emerged from the cotton locks, and while some laggard larvae remain, the number of parasites produced from a given number of females appears to be considerably less than in the old way. Much less labor is required when infested locks are used, although more space is needed in the insectary and infested locks are available only a part of the year. Last November 1,000 laggard Exeristes larvae were placed in an outdoor hibernation cage which was exposed to a minimum temperature of 12° F. Emergence from these larvae started late in February and over 76 percent had emerged by the end of March. Adults are also emerging from open cotton bolls collected from a field where a colony was liberated last fall. These bolls were stored in an open-air insectary through the winter, showing that breeding in the field occurred and that they successfully passed the first winter. All material infested by the pink bollworm was destroyed on March 1 in accordance with quarantine restrictions.

Undercooling and freezing points.--L. C. Fife and W. L. Owen, Presidio, determined the undercooling and freezing points of Exeristes larvae to be 3.40 ± 0.7° F. and 16.3° F., and for hibernating pink bollworm larvae 12.5 ± 1° F. and 26° F., respectively. The larvae of both species survived after the formation of ice crystals within the tissues or when subjected to the undercooling point but once. This confirms the results of the tests with the pink bollworm made by F. A. Fenton and A. C. Johnson several years ago when they reported that air temperatures as low as 11° F. must be reached and maintained for at least 3½ hours before any appreciable kill will result. These studies, showing that the parasite Exeristes roborator will survive lower temperatures than the pink bollworm, are not surprising, as this parasite has been established on the European corn borer in the Northern States, whereas the pink bollworm has never become established in a region with low winter temperatures.

Field population and mortality of pink bollworm.--D. L. Isler, W. L. Owen, and others of the Presidio, Tex., laboratory examined 87 samples from 14 cotton fields in the Big Bend district last November and December to determine the number and distribution of overwintering pink bollworms present in the fields after the cotton had been picked. Each sample consisted of 1 square yard of soil to a depth of 2 inches with all surface trash and the plants found within the area sampled. The number of pink bollworms for the different fields examined ranged from 3 to 52.2 with an average of 18.37 worms per square yard for the district. Of this district average, there were 2.54 worms per square yard, or 13.83 percent, in the soil, and the remaining 86.17 percent in the surface trash and in forms on the plants. In 1932 at approximately the same dates these same fields averaged 14.53 worms per square yard, with only 7.71 percent of them in the soil. The percentage of larvae in the soil which cannot be destroyed by field clean-up was approximately twice as great in 1933 as in 1932. In some fields the increase in population was because the floods of 1932 had killed many of the worms.

As all of the cotton plants together with most of the infested forms on the plants and soil surface in the Big Bend district have been burned during the last 2 years, the picture of the pink bollworm carry-over has completely changed and the worms in the soil are of greater importance. Experiments are under way at Presidio and Tlahualilo to determine the survival of the worms in the soil with different cultural treatments and in comparison with survival in bolls. The natural mortality is high and 94.24 percent of the live worms in the soil in unplowed and unirrigated plats at Presidio were dead by March 21, 1934, whereas over 97 percent were dead by this date in plats plowed and irrigated on January 8. The incomplete results indicate that the same cultural practices of plowing and irrigating early in the winter which increase the mortality of worms in the bolls will also be effective for larvae in the soil.

Bollworm hibernation.--R. K. Fletcher, of the Texas Agricultural Experiment Station, College Station, Tex., reports on the cooperative work on the hibernation of Heliothis obsoleta Fab. Last fall 10 worms were placed in each of 40 cages containing 5 types of soil. Part of the cages were buried flush with the soil level and part were left on the surface of the ground for better drainage. No emergence of moths had occurred in March, and examinations on January 23, February 22, and March 28 showed an average of 17.72 percent, 12.44 percent, and 6 percent of the pupae alive. In all examinations more bollworms were alive in the surface cages than in the buried cages. The results are in line with previous and larger experiments, to the effect that the major part of the winter mortality takes place with the aging and disintegration of the pupal cases incident to spring rains, and that the upland black and bottomland soils are more favorable for survival than the others tested.

INSECTS AFFECTING MAN AND ANIMALS

F. C. Bishopp, W. V. King, G. H. Bradley, and E. C. Cushing attended the annual meeting of the New Jersey Mosquito Extermination Association on March 7, 8, and 9. Dr. Bishopp presented a paper by himself and C. N. Smith reviewing the work done on mosquitoes during the past year in the various parts of the world. Dr. King and Mr. Bradley also presented papers--"Notes on Federal CWA Mosquito Control Projects and Salt Marsh Conditions in Florida," and "Mosquito Control Work Under the CWA in Alabama and Mississippi," respectively. The meeting was fairly well attended, and the program and discussions were very interesting and instructive. Arthur Gibson represented Canada, and representatives were present from Connecticut, New York, Delaware, and practically all counties of New Jersey.

At the Orlando, Fla., laboratory preliminary tests of the host preferences of the Australian cattle tick, Boophilus annulatus australis Fuller, indicate that the tick breeds much more readily on cattle than on deer. Apparently sufficient breeding takes place on deer, however, seriously to complicate the problem of control. In the tests a young buck and a young doe were used as hosts in comparison with two calves.

Active direction of the large mosquito control project, in cooperation with the CWA in 32 States on the part of this Division of the Bureau, came to an end on February 15. However in several of the States the work has been continued as State-directed projects, in some cases with Bureau men acting in an advisory capacity. W. V. King and G. H. Bradley have given attention to the work in Florida, Alabama, and Mississippi, W. E. Dove in Georgia, and H. H. Stage in Oregon and Washington. In the District of Columbia the work retains its original status and is still going forward on the grounds of the National Arboretum.

During the early part of the month W. V. King and G. H. Bradley made a mosquito-breeding survey in salt-marsh areas along the Atlantic Coast from Georgia to Virginia. Stops were made at Savannah, Ga.; Beaufort, Charleston, Pawley's Island, and Myrtle Beach, S. C.; Wilmington, Orange City, and New Bern, N. C.; and Norfolk, Va.

H. S. Peters spent the period March 21 to 28 in northern Pennsylvania investigating ectoparasites of wild animals, in cooperation with the Biological Survey and the State Game Commission. He reports in part as follows: "A special beaver-trapping season, extending from March 1 to April 10, offered an opportunity to examine a large number of beaver. The examinations included some animals that were still alive, some recently trapped, some trapped 3 or 4 days, and a number of pelts which had been removed from the animals 2 or 3 weeks. It was found that about 95 percent of the beaver evidently were rather heavily infested with the peculiar beetle Platypsyllus castoris Rits. Trappers stated that the beetles were generally present in large numbers, often as many as 100 on one animal. Two beaver were found with about 40 specimens but the writer could find no damage caused to the hide or animal in any way. The best pelts seemed to have the most parasites. The beetles seemed to leave the host as soon asthe animal was skinned. They were found on live beaver, and even on beaver which had been dead as long as 4 days but not yet skinned. I could not find any beetles on any pelt, even though it had just been removed from the animal. They appear to leave as soon as the bddy heat is gone." Mr. Peters had an opportunity to examine two deer that had evidently died of starvation, as their stomachs were full of balled-up laurel and rhododendron. The common biting louse Tricholipeurus virginianus Peters was present in large numbers and a few specimens of the sucking louse Cervophthirius crassicornis Nitzsche were taken. Late in the winter and early in the spring, when the usual food of deer becomes scarce, they sometimes attempt to eat laurel and rhododendron. These plants are somewhat poisonous and not very digestible, and cause the death of some deer each year. Ordinarily the starving deer are found heavily infested with external parasites.

A great deal of interest has been created by the use of blowfly maggots in infected wounds of humans, and surgeons in all parts of the United States and in many foreign countries are now using the maggot treatment. The interest which is being taken in this novel method of treatment is well shown in the great demand for information upon the subject. While a considerable number of articles have been written, they are scattered widely throughout the biological and medical literature of the world. However, through the excellent library facilities in Washington, Wm. Robinson of this Division has been able to compile a list of the publications on this subject and this has been issued in

multigraph circular E-310. The value of this service to the surgeons and laboratory technicians is indicated by the fact that one issue of 1,000 copies has already been exhausted, for the most part in meeting special requests, and a new issue with several additions is now being prepared. It includes citations of articles from the United States, Canada, Mexico, Cuba, Brazil, Chili, Peru, France, Germany, Switzerland, Spain, Hungary, Morocco, and Sudan. A copy will be mailed upon request.

As indicated in the January 1934 Monthly Letter, the discovery by E. C. Cushing, Menard, Tex., and W. S. Patton, Liverpool, Eng., that two species of flies are involved in what has been so far considered the screwworm fly (Cochliomyia macellaria) has necessitated an investigation of the biology, habits, and distribution of the two forms (C. macellaria Fab. and C. americana Cushing and Patton). Mr. Cushing is now established in field headquarters at Sonora, Tex., and will give his attention principally to an intensive study of the biologies of the two species. Various other field laboratories will participate in the investigation by studies and observations on habits and distribution.

IDENTIFICATION AND CLASSIFICATION OF INSECTS

E. A. Chapin, Washington, D. C., has detected a recently described species of Tribolium, T. destructor Uytt., among the Bureau's undetermined material of this genus. The specimens were intercepted (F H B 90623) in a shipment of seeds from Ernst Benary, of Erfurt, Germany. It is of interest to note that the species was described from specimens taken in another establishment in Erfurt, the original home of the species being at present unknown. The particular seed involved in the present case was Ampelopsis quinquefolia (L.). The species appears to be a serious pest in the seed houses at Erfurt.

Fidel del Rosario, of the Philippine Bureau of Science, holder of a Rockefeller Foundation Fellowship, is working in the Division of Insects at the National Museum on a study of the dipterous genus Psychoda. Mr. del Rosario has studied at Cornell and is now doing advanced work at Johns Hopkins University under Dr. F. M. Root.

G. Stuart Walley, of the Canadian Department of Agriculture, spent about 3 weeks in April in the Division of Insects studying Ichneumonidae with R. A. Cushman. He brought with him, for presentation to the National Museum, five paratypes and a number of specimens compared by him with types in the Canadian national collection. The majority of these are of species described by Viereck in his "A Preliminary Revision of the Campopleginae in the Canadian National Collection" and "A Preliminary Revision of Some Charopsinae, a Subfamily of Ichneumonoidea or Ichneumon Flies", while the rest are species of Provancher, Harrington, and Walley.

A specimen received from G. Stuart Walley, said to have been reared from Fenusa pumila Klug, collected at Berthierville, Quebec, June 26, 1930, by L. Daviault, has been identified by A. B. Gahan as Cirrospilus pictus (Nees), a European species not previously recorded from North America. The host is a European sawfly, accidentally introduced, which mines the leaves of birch.

J. C. Bradley and V. S. L. Pate, of the Department of Entomology, Cornell University, spent April 5 and 6 at the National Museum, examining the collections of wasps of the families Scoliidae and Sphecidae.

A wasp submitted for identification by Charles H. Hicks, Boulder, Colo., has been identified by Grace A. Sandhouse as a new species of the genus Tracheloides (Sphecidae), a genus not previously recorded from North America. Of the species previously described, two are from Europe and two from Africa. These wasps are predacious on ants.

F. M. Setzler, of the Division of Archeology of the National Museum, recently brought back from Goat Cave, along the Pecos River, Tex., an unusually well-preserved Indian mummy which had the hair of the head loaded with lice, with their eggs. The lice have been identified by H. E. Ewing as the head louse (Pediculus humanus americanus Ewing). Although the mummy had been buried in ashes for several centuries the lice were fairly well preserved. Lice from pre-Columbian Indian mummies, of which several lots have been taken, are remarkably uniform and do not show the high degree of variation seen among the head lice of Caucasians, which represent largely hybrids between the true head louse and the body louse.

It is of considerable interest to note that two economic species belonging to the very peculiar coccid genus Margarodes have recently been sent in to Dr. Morrison for examination. While comparatively little is known of the habits and biology of the members of this genus, they have hitherto, at least in the United States, been regarded chiefly as scientific curiosities. One of the species, which appears to be Margarodes meridionalis Morrison, described from Georgia and Florida, is now appearing on the roots of grasses in lawns in certain places in Arizona in immense numbers, and killing of these grasses is definitely attributed to the work of this insect. The second species, which is still unidentified specifically, as the study material of the critical stages thus far received is too fragmentary for accurate placing, is reported from the roots of citrus trees in Florida. This second species is evidently closely related to Margarodes rileyi Giard, known from the Florida Keys, and may ultimately prove to be this insect.

J. Douglas Hood, of the Department of Biology, University of Rochester, spent several days in Washington early in April, working over certain species of Thysanoptera from the A. C. Morgan collection of these insects.

INSECT PEST SURVEY

In Mardh the first number of Volume 14 of the Insect Pest Survey Bulletin was issued. Also during this period 960 notes were added to the permanent records of the Survey.

The distribution maps published in the annual summaries are attracting much favorable comment. The demand for them, even among nonentomological agencies indirectly connected with agriculture, was pronounced.

Early in the month the Bureau's Extension Entomologist, M. P. Jones, left on his spring extension trip into the Southern States. His itinerary provides that he will travel down the Atlantic Seaboard, then across the Gulf States to Texas and northward through Oklahoma, Arkansas, and Kentucky. On this trip Mr. Jones will assist the State extension workers in organizing to carry on the work started by P. D. Sanders in that region last year. He will also start some new projects.

PHYSIOLOGY AND TOXICOLOGY OF INSECTS

M. C. Swingle and J. F. Cooper, Sanford, Fla., find that the unique toxicity of nicotine silicotungstate for the southern armyworm (Prodenia eridania Cram.) may be due partly to the silicotungstate radical, because isoquinoline silicotungstate and silicotungstic acid were also toxic to first-instar larvae of this species.

J. W. Bulger, Takoma Park, Md., finds phenothiazine more toxic than rotenone to culicine mosquito larvae. This synthetic compound, at a dilution of 1 part per million, kills over 50 percent of the larvae in 8 hours and is the most toxic compound for mosquito larvae so far tested at this laboratory.

D. E. Fink, Takoma Park, finds optically active isorotenone and B-dihydrorotenone more toxic to culicine mosquito larvae than the corresponding inactive forms.

F. L. Campbell and W. N. Sullivan, Takoma Park, have studied the rate of settling of kerosene mist in the cylinders of their new testing apparatus, and find that one third of the quantity deposited at the bottom of the cylinder in 10 minutes is laid down in the first 15 seconds and that the quantity deposited in 5 minutes is only slightly less than that laid down in 10 minutes, although the mist remains visible in the cylinder for at least 30 minutes. Within certain limits of volume, the quantity of kerosene deposited by settling in a given time is independent of the quantity sprayed into the cylinder. Evaporation error in weighing glass plates covered by a film

of kerosene can be eliminated by covering the coated surface with a clean weighed plate of the same area. The deposit obtained under conditions chosen for experimental work is about 1.2 mg per square inch.

BEE CULTURE

In the March 1934 issue of the Monthly Letter it was stated that the Secretary of Agriculture had given tentative approval of the proposed marketing agreement for package bees, nuclei, and queens. At that time it was expected that final approval would be given within a few days, but the shippers who have signed the marketing agreement have been very slow in returning the agreement to Washington and it has required at least 3 weeks to get signatures from 75 percent of them. The requisite number of shippers have now signed and final approval hinges upon the exact wording of the license. As a general rule, a license follows closely the wording of the agreement; however, it may include in addition certain provisions not embodied in the agreement. In the license for package shippers and queen breeders the administration seeks further information before including a clause in the license which would make it obligatory for shippers to cancel all contracts made previous to the effective date of the agreement and which were at variance with the terms specified in the agreement. Before a clause of this nature can be included in the license an economic justification for it must be shown.

At the request of the Agricultural Adjustment Administration, General Crop Section, Jas. I. Hambleton attended a meeting of the Control Committee at New Orleans, La., on March 30. Present at this meeting were J. E. Wing, a representative from California; W. E. Harrell, from Louisiana; J. W. Newton, also from Louisiana; T. W. Burleson, from Texas; Thomas Atchison, from Alabama, proxy for D. D. Stover, from Mississippi; and Jesse E. Robinson, managing director. The purpose of the meeting was to organize the Control Committee and to adopt a method of business procedure for administering the agreement.

Representatives from the Southern States reported that practically all reliable shippers in the South will have more package-bee business this year than they can handle. Indications are that they will not be able to supply the demand. Practically all shippers in the South are doing business in accordance with the terms of the agreement. The situation in California is not so optimistic. Less than half the shippers have signed the agreement and there are indications that those who have not signed, through some unknown motive, wish to conduct their business in any way they see fit without regard

to what effect disregarding the agreement may have upon the bee-shipping industry. Should a clause be inserted in the license making it obligatory to cancel contracts at variance with the agreement, shippers, irrespective of whether they have signed or not, would be compelled to alter any unfilled contracts in strict accordance with the provisions of the agreement.

The Giannini Foundation of the University of California has just published Bulletin 555, "Economic Aspects of the Bee Industry", by Edwin C. Voorhies, Frank E. Todd, and J. K. Galbraith. The work was done in cooperation with the Pacific Coast Bee Culture Field Laboratory, Davis, Calif. The bulletin makes available for the first time a great mass of data about the beekeeping industry. Although the bulletin refers particularly to the beekeeping industry in California, it includes much data on the economic aspects of the beekeeping industry of the United States. Since this bulletin was not published by the Government, those who wish copies should request them from the Giannini Foundation.

Last year the losses of package bees in transit from certain points in the South were abnormally large, and, since it is exceedingly difficult to place the responsibility for such losses, the American Railway Express Company has requested the Southern States Bee Culture Laboratory at Baton Rouge, La., to investigate the causes of losses of package bees enroute from the South to the North. To this end the express company is willing to pay railroad transportation and to see that any necessary experimental lots of bees are furnished to the Government without cost. Warren Whitcomb, who will have charge of the work, plans to make some trial shipments during June, the month in which the heaviest losses have occurred in the past.

PLANT DISEASE ERADICATION AND CONTROL

Phony Peach Eradication

In central Georgia and Alabama, where the phony peach disease had for some time been gradually spreading and becoming more destructive to commercial peach growing, the disease was becoming established in the wild trees, and in these scattered and unnoticed trees, as well as in abandoned orchards, was building up an increasing reservoir of regional infection. The Civil Works phony peach eradication project was undertaken in December 1933 to develop winter work to meet this emergency by clearing out of these heavily infected counties all wild or abandoned peach trees likely to be centers of infection of this disease. Approximately 900 men have been employed in this project and, while the effectiveness of the work in checking the spread of the phony disease can be determined only in future years, it is the conviction

both of the local peach growers and of the technical men supervising this project that an extremely important and progressive step has been taken in the campaign to eradicate phony peach disease from the United States.

Delay in approval of organization plans by State and county officials, together with the closing of the Federal projects at a date earlier than originally contemplated, prevented the completion of the work outlined in most of the counties; but, in view of the strong local support of this work, these activities were continued practically unchanged as State Civil Works projects, and by the time the State projects are discontinued it is probable that the greater part of the activities originally outlined will have been accomplished. Up to the closing of the Federal Civil Works Administration projects (February 15, 1934) a total of 432,646 abandoned and wild trees in Alabama and 3,508,277 in Georgia had been removed by county projects. Detailed figures of the accomplishments of the State Civil Works projects since February 15 are not yet available. With the continuation of the State projects to approximately the 1st of April, however, these totals will be carried considerably beyond the 4,000,000 mark.

Citrus Canker Eradication

The Federal Civil Works project on Citrus Canker Eradication in Texas was discontinued on February 15. Yp to that date approximately 75 men had been employed by the C W A, resulting in about 9,000 man-hours of employment. Over 189,000 trees of the hardy orange (Citrus trifoliata) in stock of abandoned nurseries or escaped from cultivation and capable of barboring the citrus canker disease, were destroyed, and in addition 186 infected orchard trees near Dickinson were destroyed. This work represents an important step toward the constructive elimination of this disease from Texas.

The Citrus Canker Eradication work carried on in Texas until February 15 as a Federal Civil Works project is being continued as a State Civil Works project under the supervision of an agent of the Bureau of Entomology. Valuable progress is being made in reducing the Citrus trifoliata plants suspected of harboring canker infections, as is shown by the following table covering the first week of the State project:

Report of citrus canker eradication in the Gulf Coast area for the week ending March 15, 1934

Supervisor	County	Men employed: Number	Supervisors: Number	Labor: Total Hours	Labor: Skilled Hours	C. trifoliata destroyed: Number
O. B. Johnson (CWA)	Jefferson	5	1	120	24	658
H. Plummer (CWA)	Chambers [1]	3	1	45	15	4,949
A. Raggio (CWA)	Victoria	4	1	72	30	3,100
Wm. Paggi (Mech. CWA)	---		1		24	
J. H. Jordan (CWA)	Harris	4	1	64	24	13,365
H. Chapman (CWA)	Wharton [2]	5	--	96	24	560
W. P. Daniel (State) [2]	Brazoria	5	--	75	--	1,000
J. L. Farren (State)	Jackson	3	--	45	--	750
Totals for week		29	5	517	141	24,382
Previous totals		27	5	710	260	38,542
Grand total		--	--	1,227	401	62,924

[1] Project was completed this week.

[2] State men worked full time.

Dutch Elm Disease Control

The Federal C W A project for control of the Dutch elm disease was terminated as of February 15, and since that date this work has been continued in part as State and as local C W A projects. A weekly average of about 600 persons have been employed on this work from February 16 through March. During this period 200 additional diseased trees have been found, making a total of 1,368 diseased trees found in the area since the scouting and eradication work was first begun last summer. The diseased trees were found by the several activities as follows:

State	Diseased trees located by--			Total
	Regular scouting up to Dec. 15, 1933 (Chiefly after Sept. 1)	Federal C W A, Dec. 16 to Feb. 15, 1934	State & local C W A, Feb. 16 to March 31, 1934	
	Number	Number	Number	Number
New Jersey	740	268	157	1,165
New York	79	79	43	201
Connecticut	1	1	0	2
Total	820	348	200	1,368